

Beryllium Air Sampling Procedure

Purpose

The purpose of this procedure is to establish consistency in sampling methodology and sample strategy development to minimize systematic and random variation in sample results

Sampling Methods

Air sampling for beryllium is conducted using one or more of the following methods.

Traditional Methods

High volume
Lapel/personal
Continuous

Non-traditional Methods

Particle size
Real time monitoring

Equipment Preparation

Cleaning and storage

All sample pumps shall be cleaned prior to each day's use. Wiping the housing of the equipment with a damp cloth is generally sufficient. Unplug electric samplers before cleaning (attorney statement).

Filter holders shall be new or have been cleaned prior to use. Reusable filter holders are usually washed using a soap solution and scrub brush, rinsed, and allowed to air dry. When not in use, cleaned, new, or pre-loaded filter holders and filters must be stored in a non-production area inside a dust-tight enclosure, such as a zip lock bag, to prevent their contamination.

Tweezers used to handle filters should be cleaned before each day's use and as needed throughout the air sampling day

Inspection

Equipment components such as sampler housings, filter heads, tubing, electric cords, extension cords, storage boxes, equipment carts, etc. shall be inspected for damage, deterioration, cleanliness etc. at the beginning of each work day. Specifically, High volume sample heads must be inspected for deterioration of the gasket, and corrosion or poor alignment of the mating surfaces. This inspection is normally done during the cleaning process.

Minimum Calibration Frequency

| | |
|-------------------------|--------------------|
| Continuous samplers | Quarterly |
| High Volume samplers | Quarterly |
| Lapel/personal samplers | Daily |
| Any repaired sampler | Before initial use |

Traditional Sample Methods

High Volume Method

A high volume air sampler draws air through a filter at a high rate of flow enabling the capture of beryllium at lower airborne concentrations. The current vacuum equipment draws air through a 10.5 centimeter diameter Whatmann 41 filter at a rate of about 200–400 liters per minute. The common types of air samples taken are the General Area (GA), Breathing Zone (BZ), and Process Sample (PS).

Low Flow Method

A low flow sampler normally consists of a low volume battery powered portable vacuum pump with a 0.8 micron pore size mixed cellulose ester filter/cartridge calibrated to a sampling rate of about 2 Lpm. The common types of air samples taken are the General Area (GA) and Breathing Zone (BZ).

Continuous Method

A continuous air sampler consists of an electric powered vacuum pump and a filter cassette where the flow is regulated with a critical orifice. A typical configuration is a vacuum pump and a 25 millimeter diameter Whatmann 41 filter/cassette calibrated to a flow of 10 to 20 liters per minute. This method is designed for sampling over long periods of time. The common types of air samples taken are the General Area (GA) and Process Sample (PS).

Sample Types

General Area Samples

General area samples are taken in the normal operating area around a specific process or activity. Samples taken using the high volume method are normally obtained for 30 minutes but can range from about 10 minutes to one hour in duration. Low flow samplers can be used for GA samples with durations of about one to eight hours. They are most often used in areas where the noise from a high volume sampler would be deemed unacceptable, such as in an office. Samples taken using the continuous method are usually obtained for 8 to 24 hours.

There are two basic types of general area samples. The first is used to account for non-specific activity time such as when an operator spends time at a stationary location such as a desk or chair. The second type is relative to the time in the work area surrounding a specific task or activity. This second type is often associated with a corresponding breathing zone sample.

Placement of the first type of general area sample is normally at breathing zone height on a stand or tripod located:

1. At the operator's desk, chair, etc.
2. Wherever the operator spends time when not performing a specific production task or activity.

Placement of the second type of general area sample should be downwind of the identified process or activity in areas such as:

1. Normal paths of operator travel when not wearing a respirator. GA samples should not represent emissions to which the operator is exposed when performing specific tasks requiring respiratory protection or specific close-in tasks normally sampled at the operators breathing zone.

2. In an aisle or area next to the operation which is frequented by other employees, especially if it is near an operator wearing a respirator.
3. As a general rule, a general area sample is obtained within six to ten feet of a breathing zone sampling location.

Breathing Zone Samples

Breathing zone (BZ) samples are obtained within a one foot radius of an operator's head.

Breathing zone samples collected using the high volume method are usually taken during periods of high potential or actual exposure. They are often taken during respirator required tasks. On difficult operations where the activity of sampling may pose a hazard to the person sampling or being sampled the sample may be taken at a location equivalent to the operator's position relative to the potential source of the airborne beryllium. Sample duration should be the complete time it takes to perform the operation or in case of a prolonged operation, at least five minutes. If an operation takes less than one minute to perform, sampling time should be a minimum of one minute.

CAUTION: Persons obtaining air samples must always wear the required respiratory protection and other personal protective gear for the task being performed.

Breathing zone samples taken using low flow samplers are usually taken to be representative of a worker's exposure during an entire work shift. A low flow pump is worn on a belt while the filter cartridge is located on the person's lapel and connected to the pump with a length of plastic tubing. It is recommended that low flow samplers not be used for sampling periods for less than one hour, especially if the potential exposure is believed to be low.

Continuous Samples

Continuous samples are taken in an area which normally represents a general area sampling location. However, continuous samplers can be used to audit equipment or areas not generally associated with an operator's normal path of travel. They may also be used to determine exposure potential before, during, or after an area evacuation.

Process Samples

High volume, low flow or continuous sampling pumps may be used to collect this type sample. Process samples are usually taken within inches of a potential source to identify and/or assess a rate of emission for the contaminant being sampled. This information is used to identify sources, estimate potential worst case exposures, and to evaluate or initiate engineering controls.

Field Sample Procedures

High Volume Method

1. Wash hands prior to assembling filters. Assemble filter heads in an area where the potential for process related contamination is reasonably low. With clean tweezers, place one filter paper in the top section of the sampling head and thread the two sections snugly together. Several sampling heads can be made up in advance and stored in an dust tight container or plastic bag. Thread the sampling head onto the sampler. Check for binding of the filter paper. Record the sampler number and flow rate. Proceed to take the sample and note the start time to the second. It is most convenient to start and stop samplers at minute points.

2. After the sample has been taken, remove the sample head from the pump by smoothly unscrewing the head. Unscrew the filter assembly in a horizontal position. Remove the filter paper with clean tweezers and put the filter paper into a pre-numbered cellophane bag. **Grasp filters from only the unexposed outer edge. Close/seal the bag.**

Low Flow Method

Use pre-loaded numbered or coded filter cassettes. Clean hands before handling cassettes. Assemble the pump to the filter cassette using Tygon tubing of adequate length. Cassette filter quick connect fittings are recommended. Be certain the Tygon tubing has an adequate number of clips to facilitate the tubing placement when sampling on people (usual minimum is three). The inlet plug on the filter cassette should not be removed until ready to begin sampling. Place the pump on the individual at a location comfortable to the wearer. Provide a belt if one is not available. Pump placement should take into account how it might interfere with the wearer's motions, the presence of heat or chemicals, the wearing of other work equipment such as tool belts, etc. Particular care must be taken when affixing the Tygon tubing to the wearer's clothing. Make sure the tubing stays close to the body so it does not snag or pose a safety hazard. At times person's wearing finer clothing may need to be sampled. Care should be taken to avoid snagging fine fabrics. Another option is to have the person wear an overgarment such as a lab coat to which the sampler can be attached. The cassette must be attached within the breathing zone of the wearer. In special instances, such as welding, the cassette must be placed so it remains in the breathing zone under the welding helmet.

After taking the sample, remove the cassette and cap both ends.

Continuous Method

Use pre-loaded numbered or coded open-face filter cassettes. Clean hands before handling cassettes. Assemble the pump to the filter cassette using Tygon tubing of adequate length. Cassette filter quick connect fittings are recommended. Be certain the Tygon tubing or electrical extension cords are located out of the way of production activities. Be certain the pump is adequately secured so it cannot be easily dislodged posing a potential safety hazard.

All Methods

Record all pertinent information on the sampling record sheet noting the sample number, date, start and stop times, location and operation, sampler flow rate, sample duration, and if applicable, operator name and clock number. Also record any pertinent conditions which might influence the sample results.

Note: Filters which:

contact an object such as hands, the person being sampled, are directly contaminated by process spray, chips etc.;

develop a hole or do not seal during the sampling process;

are in a cracked cassette;

are used in a pump which failed;

are potentially contaminated such as when a sampler is accidentally knocked over or struck sharply by an object;

Shall be Discarded without analysis